BONDING OF ALUMINUM FOILS TO SAPPHIRE AND THE EFFECT OF FOIL THICKNESS ON MECHANICAL BEHAVIOR

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Foils of varying thickness of high purity aluminum have been bonded between cylinders of sapphire with flat polished surfaces. The foil thicknesses ranged from 25 µm to 250 µm. Bonding was performed under conditions of ultra-high vacuum with the bonding surfaces cleaned by sputtering. Surface cleanliness was characterized by Auger electron spectroscopy and residual gas analysis showed a working time of many hours prior to surface re-contamination. Bonding was performed entirely in the solid state under conditions of 600¡C, 38 h, and 10 MPa applied pressure. Bonds were machined into bend beams for four point loading. The metal foil was oriented normal to the long axis of the beams in order to study opening mode behavior. The beams were notched on the tensile face in the metal foil in order to localize crack initiation. The varying foil thickness provides a variation in constraint which affects the extent of plasticity and the load at which the crack growth initiates.

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